Optimal Degree of Public Information Dissemination

Camille Cornand
Frank Heinemann

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Abstract

In currency exchange markets, there is a conflict between individual decisions and the socially optimal solution. Whereas agents have a coordination motive to take the same position, at the social level effective market coordination *per se* is not socially valuable, and the central bank aims at driving agents' actions as close as possible to the economic fundamental state. Some studies argue that it might be better to withhold public information because its potential to serve as a focal point induces agents to exaggerate the importance of public announcements. This paper shows that public information should always be provided with maximum precision, but under certain condition not to all agents. Restrictions on the degree of publicity are a better instrument with which to prevent the negative welfare effects of public announcements than restrictions on their precision are. The optimal degree of publicity is always positive.

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Camille Cornand
GATE – CNRS
Lyon 2 University
93 Chemin des Mouilles
69130 Ecully
France
cornand@gate.cnrs.fr

Frank Heinemann
University of Munich
Ludwigstr. 28 R.G.
80539 Munich
Germany
frank.heinemann@lrz.uni-muenchen.de

1 – Introduction

There is an ongoing debate about the relative merits of public information in financial markets and in macroeconomic environments that are characterized by positive externalities. During speculative episodes on the currency exchange market, agents not only have an interest in responding to the underlying fundamental but also have a coordination motive to take the same action, because their actions represent strategic complements. Nevertheless, at the social level, effective market coordination *per se* is not socially valuable, and the central bank aims at driving agents' actions as close as possible to the economic fundamental situation. Macroeconomic stabilisation tries to avoid any form of overreaction, and crashes in particular. In situations of financial distress, the strong focal potential exerted by public information can be welfare damaging because it induces overreactions.

Previous literature has concentrated on analyzing the optimal precision of public information. They generally yield "bang-bang solutions", where public information should either be as precise as possible or be avoided entirely. In this paper, we explore another dimension of public information: the degree of publicity, by which we mean the proportion of economic agents amongst whom a message is common knowledge. We show that it may be optimal to provide information with an interior degree of publicity either by informing only predetermined agents or by informing agents at random with a probability below one.

The discussion about the distinct effects of public and private information started with the application of the theory of global games to speculative-attack games by Morris and Shin (1998, 1999). They show that speculative-attack games have unique equilibria if private information is sufficiently precise in relation to public information. Heinemann and Illing (2002), Metz (2002) and Bannier and Heinemann (2004) analyze how the ex-ante probability of currency crises is affected by the relative precision of public and private information.

Morris and Shin (2002) present a stylized coordination game with a unique equilibrium in which public information may be detrimental to welfare if its precision is limited by inevitable forecast errors. Their model emphasizes the role of public information as a focal point for private actions. Strategic complementarities provide incentives to coordinate on the publicly announced state of the world and neglect private information. If public announcements are inaccurate, private actions are drawn away from the fundamental value. Public information is a double-edged instrument: it conveys valuable information, but the desire to coordinate leads agents to condition their actions stronger on public announcements than is optimal. Both effects get stronger if the precision of public information rises. An infinite precision of public information maximizes welfare. However, if its precision has an upper limit, it may be better not to provide any public information at all than disseminating information with maximum precision. Morris and Shin (2002) conclude that a welfare maximizing information provider might want to reduce the precision of public signals or avoid them entirely.

All of these papers distinguish two extreme kinds of signals: messages that are received by single agents only (private information) and messages that are common knowledge to all agents (public information). In the present paper, we allow for intermediate degrees of publicity, i.e. messages that are common knowledge to only a fraction of agents. It turns out that the degree of publicity is a powerful instrument of information policy. Especially in situations where public information may be detrimental by coordinating agents' activities away from social optimum, messages of high precision but limited publicity are superior to pure public information with low precision: for those who receive the signals, a high precision of information about underlying fundamentals enhances efficiency of private decisions. The limited degree of publicity, however, reduces incentives to overreact to public signals and prevents them from reducing welfare by pulling actions away from social optimum. Revisiting the beauty contest framework of Morris and Shin (2002), we show that public information should always be provided with maximum precision, but under circumstances not be disclosed to all agents. The optimal degree of publicity is always positive.

Our framework enables us to find some original economic policy results. We show that restrictions to the number of people receiving public signals are a more efficient tool for avoiding precarious coordination effects than the ambiguity of signals is. The rationale behind this result is linked with the reduction in agents' overreaction to sometimes imprecise (mistaken) public announcements. The central bank disposes of two different tools to conduct economic policy: the precision of information and the level of information disclosure. Both instruments are double-edged: higher precision improves the quality of private decisions by those who receive information and higher publicity enlarges the number of those who benefit from information. At the same time, both instruments raise incentives to overweigh public signals. To understand the advantage of limited publicity, consider an extreme case: suppose that in (certain) appropriate situations the central bank does not release any public information, as recommended by Morris and Shin (2002). How does social welfare change if the central bank releases information with the highest possible precision to a very small proportion of agents? Those who receive the information benefit from its precision. The small degree of publicity, however, prevents its role as coordination device. Thereby, agents who receive this public signal attribute the optimal weight to it when maximizing expected utility. It is always valuable to have better information as long as agents do not overreact to it, which can be prevented by a limited degree of publicity. Therefore, it can never be optimal to withhold information entirely.

Angeletos and Pavan (2004) and Hellwig (2004) also challenge the conclusions of Morris and Shin (2002). Considering economies with increasing returns to scale (Angeletos and Pavan) or monopolistic competition (Hellwig), they find that the precision of public information is always welfare increasing. The reason for this is the different notion of individual utility. In Morris and Shin (2002), the payoff of a player decreases with the distance between his own action and the action of others, but this distance is irrelevant from a social perspective. As Angeletos and Pavan (2004, p.3) put it: "*[…] more transparent public information facilitates more effective coordination, which is valued by the market but not by the society*". Instead, they consider environments in which there is complementarity at the social level so that coordination is socially valuable[1]. However, financial markets are better characterized by coordination games, in which it is socially desirable to avoid any form of overreaction, so that it is always better to evaluate a currency or a firm in terms of the fundamental state of the economy rather than the beliefs of market participants.

We define the degree of publicity of a message as the largest fraction of agents amongst whom the message is common knowledge. A message is common knowledge among some groups of agents if each agent in this group knows that every other agent in the group knows that each member of the group received the message and so on. The degree of publicity is closely related to common *p*-beliefs that have been introduced by Monderer and Samet (1989). An event is common *p*-belief among agents if all of them believe with at least probability *p* that this event has occurred, all agents believe with at least probability *p* that all others believe with at least probability *p* that this event has occurred, and so on. A message that is released to some fraction *p* of the total population is common knowledge among this group of agents and common *p*-belief among the total population. Thereby, we suggest a practicable mechanism to induce common *p*-beliefs and overcome the traditional dichotomy between strictly public information on the one hand and strictly private information on the

[1] Angeletos and Pavan (2004, p.3) argue that this "*is likely to be the case in economies with production and demand spillovers, network externalities, or incomplete financial markets*".

other. Hellwig (2002) shows that common *p*-beliefs solve a puzzle arising from the distinct features of speculative-attack games with public and private information. The more precise private information is in relation to public information, the lower is the degree of common *p*-beliefs. If *p* is sufficiently low, the speculative-attack game has a unique equilibrium. Common *p*-beliefs and our degree of publicity are both intermediate concepts to fill the dimension between pure private and pure public information continuously.

Recent laboratory experiments on coordination games with private and public information (Cabrales, Nagel and Armenter (2003), Heinemann, Nagel and Ockenfels (2004) and Cornand (2004)) indicate that there are only small differences in the perception of public and private signals. Their data reject the hypothesis that predictability is reduced with public information. On the contrary, they show that agents' behaviour is very similar in both informational contexts. This result suggests that public information does not necessarily lead to common knowledge: differences in the treatment of public information seem to prevent common knowledge and create lower levels of higher order beliefs. A possible explanation is provided by Nagel (1995) and Kübler and Weizsäcker (2003), who show that subjects in laboratory experiments behave in accordance with a limited number of levels of reasoning about others. On the other hand, Cornand (2004) shows that subjects overweigh the public signal if they receive a private and a public signal about the payoff of a coordination game. Thereby, the focal potential of public information cannot be neglected. We conjecture that intermediate concepts like common *p*-beliefs are better qualified to describe the state of minds after public announcements. A possible interpretation for a real economy is that there is always some probability that an agent misses an announcement or misunderstands it.

The rest of the paper is structured as follows. Section 2 presents the model. Section 3 solves for the unique equilibrium and establishes the position of the model by Morris and Shin (2002) as a particular case of our framework. Section 4 gives our policy prescription results. Section 5 concludes.

2 – The Model

Our framework is based on Morris and Shin (2002) who describe a reminiscence of Keynes' "beauty contest" example. Whereas they assume that public announcements are received by all agents and the information provider can choose the precision of public signals, we enlarge the choice set of the information provider by adding a second dimension: the degree of publicity that we model by the fraction of agents who receive a signal. We consider two schemes of providing information: public signals may be disseminated to a predetermined group of agents or to each agent with some probability. The first interpretation accounts for the possibility of central banks to spread news in certain communities or in a language that is understood only by some agents. The second interpretation is more related to the practical difficulties in achieving common knowledge. Public announcement may be spread though media, but each market participant acknowledges a certain medium only with some probability. These probabilities may differ for different media, so that a central bank can choose the degree of publicity by selecting media for publication.

2.1. A beauty contest framework

Our model is a principal-agent two-stage game in which the central bank (principal) determines the optimal precision and the degree of publicity that maximise welfare before the speculators (agents) take their decision. There is a continuum of agents, indexed by the unit interval [0,1]. Agent *i* chooses an action $a_i \in \Re$, and we write *a* for the action profile over all agents. The payoff function for agent *i* is given by

$$u_i(a,\theta) \equiv -(1-r)(a_i-\theta)^2 - r\left(L_i - \overline{L}\right)^2,$$

where θ is the fundamental state of the economy and *r* is a constant, such that $0 \le r \le 1$ and $L_i \equiv \int_0^1 \left(a_j - a_i\right)^2 dj$, $\overline{L} \equiv \int_0^1 L_j dj$.

The utility function for individual *i* has two components. The first component is a standard quadratic loss in the distance between the underlying state θ and his action a_i. The second component is the "beauty contest" term. The loss is increasing in the distance between *i*'s action and the average action of the whole population. The parameter *r* is the weight attributed to this strategic uncertainty: the higher *r* is, the higher is the external effect arising from the coordination motive of decision makers.

However, this spillover effect is socially inefficient and disappears at the social level. Therefore there may be a conflict between individual decisions and the socially optimal solution. Social welfare is defined as the (normalized) average of individual utilities, given by

$$W(a,\theta) \equiv \frac{1}{1-r}\int_0^1 u_i(a,\theta)di = -\int_0^1 (a_i - \theta)^2 di \, .$$

As a consequence, the social planner, who cares only about social welfare, seeks to keep all agents' actions close to the state θ.

2.2. Structure of uncertainty and timing of the game

Agents face uncertainty concerning θ. However, to decide on an action, they potentially receive two kinds of signals that deviate from θ by some error terms with normal distributions. Each agent receives a private signal

$$x_i = \theta + \varepsilon_i \quad \text{with} \quad \varepsilon_i \sim N(0,1/\beta).$$

Signals of distinct individuals are independent and the distribution of private signals is treated as exogenously given. Eventually, agents have access to a public signal

$$y = \theta + \eta \quad \text{with} \quad \eta \sim N(0,1/\alpha).$$

The public signal is given to each agent with some probability P. Since we have a continuum of identical agents, the fraction of agents who receive public information equals P almost certainly. Without loss of generality, we may assume that agents $i \in [0, P]$ receive the public signal and agents $i \in (P, 1]$ must rely on their private signals only. The signal y is "public" in the sense that the actual realization of y is common knowledge among agents $i \in [0, P]$. Parameters α and β are the precisions of public and private signals.

The optimal action of agent i is given by the first order condition:

$$a_i = (1-r)E_i(\theta) + rE_i(\bar{a})$$

where E_i (.) is the expectation operator of player i and $\bar{a} = \int_0^1 a_j dj$ is the average action in the population. The following expressions come straightforwardly:

- The expected state for an agent who does not receive y but possesses his own private information is given by $E(\theta \mid x_i) = x_i$ and his expected average action is given by $E(\bar{a} \mid x_i) = x_i$.

- The expected state for an agent who receives y on top of his own private signal is given by: $E(\theta \mid y, x_i) = \dfrac{\beta x_i + \alpha y}{\alpha + \beta}$ and we also have his expectation of the others' signals $E(x_j \mid x_i, y) = E(\theta \mid y, x_i) = \dfrac{\beta x_i + \alpha y}{\alpha + \beta}$.

The game consists of two stages. First, the principal (central bank) chooses the level of public information disclosure P and its precision α in order to maximize expected welfare. Then, in the second stage, agents choose their actions a_i maximizing expected utility. An equilibrium of the game consists of strategies for the central bank and for the continuum of speculators such that no player has an incentive to deviate. First, we solve the subgame of the second stage for a given combination of P and α.

3 – Equilibrium

Agents who do not receive the public signal choose $a_i = x_i$. For the normal distribution all conditional expectations are linear combinations of available information. The first order condition shows that the optimal action is a linear function of conditional expectations. Thereby, the optimal strategy of any agent who receives the public signal y is a linear strategy of the form

$$a_j = \gamma x_j + (1-\gamma) y .$$

The optimal weight γ depends on an agent's expectations about the behaviour of other players. Because the best response of any agent is unique, in equilibrium, all players choose the same γ. The conditional estimate of the average action across all agents is then given by

$$E(\bar{a}) = P[\gamma E(x_j) + (1-\gamma) E(y)] + (1-P) E(x_j).$$

For any agent i who receives both signals:

$$\begin{aligned} E(\bar{a} \mid x_i, y) &= P\,[\gamma\, E(x_j \mid x_i, y) + (1-\gamma) y] + (1-P) E(x_j \mid x_i, y) \\ &= P(1-\gamma) y + (P\gamma + 1 - P) E(x_j \mid x_i, y) \\ &= P(1-\gamma) y + (P\gamma + 1 - P) \frac{\beta x_i + \alpha y}{\alpha + \beta}. \end{aligned}$$

Thus, agent i's optimal action, for $i \in [0, P]$, is given by

$$
\begin{aligned}
a_i &= rE_i\left(\bar{a} \mid x_i, y\right) + (1-r)E_i\left(\theta \mid x_i, y\right) \\
&= \frac{x_i\left[\beta\left(1 - rP\left(1-\gamma\right)\right)\right] + y\left[\alpha + \beta rP\left(1-\gamma\right)\right]}{\alpha + \beta}.
\end{aligned}
$$

Comparing coefficients and solving for γ, yields the equilibrium of the subgame,

$$\gamma^* = \frac{\beta(1-rP)}{\alpha + \beta(1-rP)}.$$

In equilibrium, agents with public information choose

$$a_i = x_i \frac{\beta(1-rP)}{\alpha + \beta(1-rP)} + y \frac{\alpha}{\alpha + \beta(1-rP)}.$$

This implies

$$\bar{a} = P\left[\gamma\theta + (1-\gamma)y\right] + (1-P)\theta,$$

which gives, after some simplifications

$$\bar{a} = \theta \frac{\alpha(1-P) + \beta(1-rP)}{\alpha + \beta(1-rP)} + y \frac{P\alpha}{\alpha + \beta(1-rP)}.$$

This equation shows that, in equilibrium, actions are distorted away from θ towards y. The distortion increases in the precision of public information, α, and in the proportion of agents receiving it, P.

- when $\alpha \to 0$, $P \to 0$ or $\beta \to \infty$, then $\bar{a} = \theta$: when public information is extremely imprecise or given to almost nobody, or when private information is extremely precise, then public information loses its coordination role and is ignored.

- when $\alpha \to \infty$ or $\beta \to 0$, then $\bar{a} = \theta(1-P) + yP$: when public information is extremely precise or private information extremely imprecise, those who receive public information will disregard private information and choose $a_i = y$. The others can only use private signals, which are distributed around θ. Hence, those without public information will choose an average action of θ.

The model of Morris and Shin (2002) represents a special case of our framework in which P = 1 is exogenously fixed. Under such circumstances, it is certain that all agents receive a private and a public signal (y is thus common knowledge among the agents). Here, the unique equilibrium is given by

$$a_i = \frac{\alpha y + \beta(1-r)x_i}{\alpha + \beta(1-r)}.$$

The weight on public information clearly exceeds its weight in $E(\theta \mid x_i, y)$, which is only $\alpha/(\alpha+\beta)$. This mirrors the disproportionate impact of the public signal in coordinating agents' actions. Since there is no other instrument, the only way to restrict the potential damaging effects of public information is a limitation of their precision. Our more general framework provides the central bank with a second instrument that may be superior in reducing the damages of public information.

4 – Welfare implications and policy prescriptions

Let us now turn to the first stage of the game and derive the optimal degree of publicity. Since this is our main innovation, we will first calculate the optimal degree of publicity P for precision α being given exogenously, before we turn to the more general solution, in which we solve for the optimal combination of both variables.

4.1. Optimal degree of information disclosure

How is welfare affected by the degree of public information disclosure? And what is the interplay between the precision of information and the level of disclosure in terms of welfare effects? Expected welfare is given by

$$E(W(a,\theta) \mid \theta) = -E\left[\int_{i\in(0,1)} (a_i - \theta)^2 \, di \mid \theta\right]$$

$$= -\int_{i=0}^{P} E\left[(a_i \mid x_i, y - \theta)^2 \mid \theta\right] di - \int_{P}^{1} E\left[(x_i - \theta)^2 \mid \theta\right] di$$

$$= -P\,\frac{\beta(1-rP)^2 + \alpha}{(\alpha + \beta(1-rP))^2} - (1-P)\frac{1}{\beta}.$$

Maximizing welfare with respect to $0 \le P \le 1$ gives $P^* = \min\left\{1, \frac{\alpha+\beta}{3r\beta}\right\}$. The optimal degree of publicity P^* is smaller than one if, and only if $\frac{\alpha}{\beta} < 3r - 1$. This shows that it is better to disclose public information with a low precision only to a limited audience if coordination is a sufficiently strong motive. For r < 1/3, we always get the corner solution P^* = 1.

Conclusion 1: *For all $r \geq 1/3$ (sufficiently strong strategic complementarity), the optimal degree of publicity P^* (α,β) is smaller than 1, if the private signal is sufficiently precise compared to the public signal.*

The intuition for such a result is that a partial disclosure of information can avoid overreaction to a signal which is potentially far from the true state (when the public signal is imprecise). An imperfect degree of common information disclosure generates a mechanism in which the negative influence of agents' overreaction is outweighed by the positive impact of coordination (on θ).

In terms of economic policy, the central bank (in order to maximize social welfare) can have an interest in not perfectly disclosing public information (i.e. not giving public signals with probability 1) because of agents' overreaction to public announcements. The existence of a public signal received with a certain probability smaller than one will mitigate the potentially "bad effect" of overreaction while keeping the "good effect" of coordination on θ. Hence, the central bank is provided with an open door for "constructive ambiguity", which means that it can intentionally create ambiguity by disclosing information to a certain level (that is with some probability) implying relatively poor visibility, so as to avoid potentially damaging self-fulfilling beliefs and limit overreaction to its timely but not necessarily accurate public announcements.

For a better interpretation, we calculate the relative precision between the two types of signals, for which public information y should be disclosed with probability 1. As $r \leq 1$, we have $\frac{\alpha+\beta}{3r\beta} \geq \frac{\alpha+\beta}{3\beta}$. So $\frac{\alpha}{\beta} \geq 2$ implies P^* = 1. When the public signal is at least twice as precise as the private signal, public information should be disclosed to all agents with probability 1.

On the other hand, if the private signal x_i is extremely precise (so that $\beta \to \infty$), or when the public signal y is extremely imprecise (so that $\alpha \to 0$), then it is optimal to disclose the public signal with a probability of $P^* \to 1/(3r)$.

In the limit, when α approaches zero, public information becomes worthless and will be disregarded even by those who receive it. Thus, for α =0, the degree of publicity is irrelevant.

However, as soon as public signals have some content ($\alpha > 0$), the optimal degree of publicity exceeds $\frac{1}{3r}$ and increases with rising precision α.

4.2. Optimal precision of information

The determination of a unique equilibrium also enables us to address the question of the impact of signals' precision in terms of welfare effects. The impact of the precision of public information on expected welfare is

$$\frac{\partial E(W \mid \theta)}{\partial \alpha} = P \frac{\alpha + \beta(1 - rP)(1 - 2rP)}{(\alpha + \beta(1 - rP))^3}.$$

Apparently,

$$\frac{\partial EW}{\partial \alpha} \geq 0 \Leftrightarrow \frac{\alpha}{\beta} \geq (1 - rP)(2rP - 1).$$

The sign of $\frac{\partial E}{\partial \alpha}$ is ambiguous. If $2rP > 1$ and private information is sufficiently precise, an increase in the precision of public information is detrimental to welfare. The case $P = 1$ resembles Morris and Shin's (2002) result according to which the precision of public information increases welfare if, and only if $\alpha/\beta \geq (1 - r)(2r - 1)$.

If $2rP < 1$ or if private information is imprecise (small β), then the precision of public information increases welfare.

Conclusion 2: *Increasing the precision of the public signal has positive welfare effects if the degree of publicity is sufficiently small.*

We also have:

$$\frac{\partial E(W \mid \theta)}{\partial \beta} = \frac{P(1 - rP)\left(\alpha(1 + rP) + \beta(1 - rP)^2\right)}{(\alpha + \beta(1 - rP))^3} + (1 - P)\frac{1}{\beta^2} \geq 0.$$

This means that increasing the precision of private information is always a better policy.

Conclusion 3: *Increasing the precision of the private signal is always welfare increasing.*

If public information can be provided with infinite precision ($\alpha \to \infty$), then $y = \theta$ almost certainly and full publication (P = 1) leads agents to choose $a_i = y$. Thereby, the expected welfare loss is zero, which is the first best solution.

4.3. Second best optimum for a limited precision of public information

Inevitable forecast errors limit the precision of public information, which is, after all, just the inverse variance between the public announcement and the ex-post realization of the fundamental state. Morris and Shin (2002) show that for P = 1, public information with limited precision can lead to a higher welfare loss than no public information at all: agents may prefer following a public signal, even of poor quality, because this enhances coordination. However due to the poor quality of y, the coordination point is likely to be distorted away from the efficient level θ. Therefore, the public signal imposes an external effect: it induces all individuals who receive it towards the same action and, thereby, leads to a likely derivation of activities from θ. Such amplification in the initial noise is painful for all agents and damaging for welfare of the society as a whole.

If the principal has the option to choose the optimal degree of publicity P^*, then the optimal precision is always maximal. To see this, compare P^* with the condition for welfare increasing effects of public information precision. An increase in α raises expected welfare if $\alpha \geq \beta\left(1 - rP\right)\left(2rP - 1\right)$. The optimal degree of publicity P^* is less than or equal to $\dfrac{\alpha + \beta}{3r\beta}$, which is equivalent to $\alpha \geq \beta\left(3rP^* - 1\right)$. Since $\left(3rP^* - 1\right) > \left(1 - rP^*\right)\left(2rP^* - 1\right)$, we conclude that an increase in α always raises expected welfare if the degree of public information is chosen optimally.

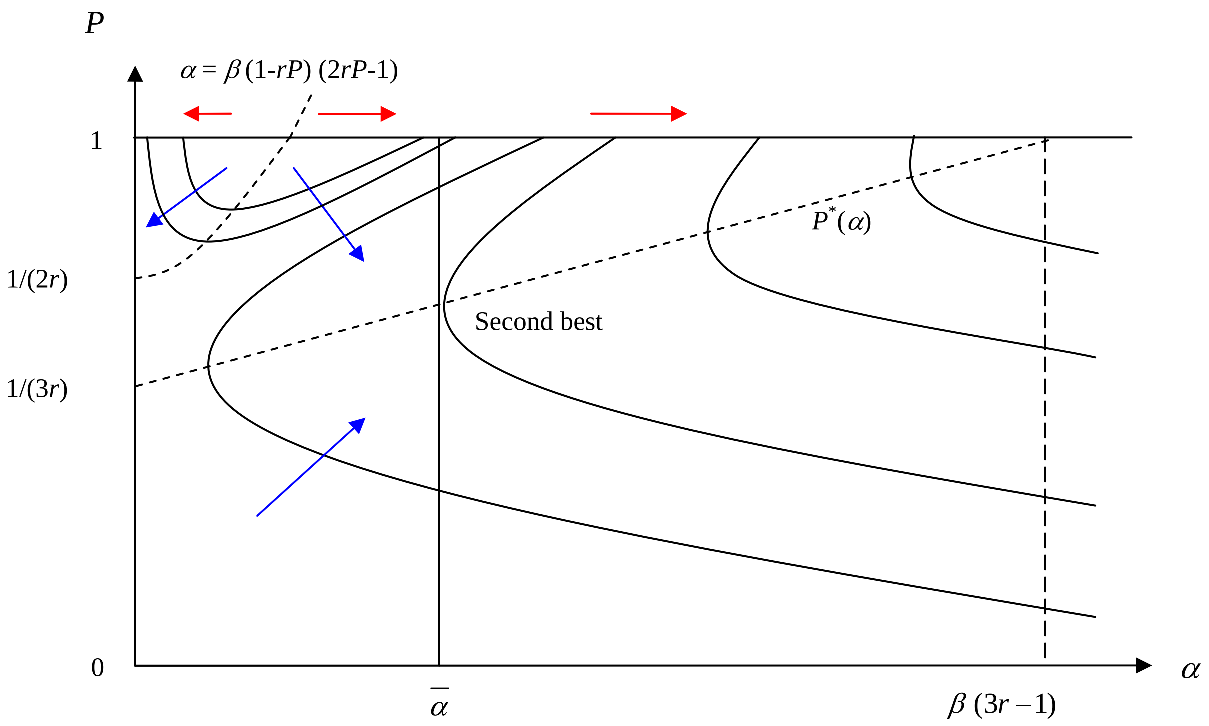
Whenever the principal faces upper limits to the possible precision of public information, such that $\alpha \in \left[0, \overline{\alpha}\right]$, then the second best solution is to provide public information with the highest possible precision $\overline{\alpha}$ and release it to a proportion $P^*(\overline{\alpha})$ of all agents. The optimal degree of publicity is smaller than 1 if $\overline{\alpha}$ is sufficiently small. Whenever $\overline{\alpha}$ is so small that Morris and Shin's (2002) conclusion applies for P = 1, then $P^*(\overline{\alpha})$ < 1. But, even if $\overline{\alpha}$ is larger, so that Morris and Shin would prefer maximum precision over none, the optimal degree of publicity may be less than one.

As a consequence, we can state the main result of the paper: even if the precision of public information is restricted by some $\overline{\alpha}$, the central bank should provide public information with maximal (possible) precision, *but* with some probability P that is below 1 if $\overline{\alpha}$ is sufficiently small.

Main theorem: *The second best optimal policy for* $\alpha \in [0, \overline{\alpha}]$ *is given by* $\alpha^* = \overline{\alpha}$ *and* $P^* = \min\left\{1, \dfrac{\overline{\alpha} + \beta}{3r\beta}\right\}$.

We summarize these findings in Figure 1. Solid curves represent social welfare contours in the (α,P)-space. Arrows indicate the direction of increasing welfare. The lower broken line is $P^*(\overline{\alpha})$. The upper broken curve indicates the points above which an increase in α reduces welfare. Whenever $\overline{\alpha} < \beta\,(3r-1)$, the optimal degree of publicity is smaller than one.

Figure 1 – Social welfare contours in (α,P)-space



When the central bank discloses public information with certainty (P = 1), and it cannot achieve public signal's precision beyond some upper boundary, no information ($\alpha = 0$) may be better than maximum precision ($\overline{\alpha}$). Morris and Shin (2002, p. 1529) conclude that: "*[…] even if the choice of α entails no cost, we will see a "bang-bang" solution to the choice of optimal α in which the social optimum entails either providing no public information at all […] or providing the maximum feasible amount of public information*".

Such a ("bang-bang") result does not hold anymore, once we relax the assumption that public signals are received by all agents with certainty. The tool of limiting the degree of publication allows for the exploitation of the positive feature of precise as possible public information: those who receive the public signal can improve their decisions, while withholding information entirely waives these profits for all agents.

5 - Conclusion

A lack of transparency has often been blamed for the turbulences that have swept through financial markets in recent years. Consequently, the international financial institutions have actively promoted more transparency among their member countries. Any information is valuable to the receiver and it is natural to conjecture that transparency increases welfare.

Recently, a number of papers have argued that transparency may actually reduce expected welfare from an ex-ante point of view. Geraats (2002) gives an overview with several examples of welfare reducing information in a Barro-Gordon framework. The theory of global games shows that public information may induce self-fulfilling beliefs and has the potential to destabilize an economy. To the extent that financial markets exhibit strategic complementarities, common knowledge amplifies the impact of new information and provokes runs into or out of a market, because of higher order beliefs.

If public information may be detrimental to welfare, the question arises of how to respond to this threat. So far, most authors argue that information should be withheld or the precision of public information should be reduced. This paper shows that it may be more efficient to reduce the degree of publicity and disseminate information in communities or through media that reach only a part of all traders. A limited degree of publicity leads to common knowledge among receivers and to common p-beliefs among the whole population. It combines the positive effects of valuable information for those who get it with a confinement of its threats by limiting the number of receivers. This is a second-best solution for the case that the precision of public announcements is bounded by exogenous restrictions.

Heinemann and Illing (2002) suggest yet another solution: the central bank should release information to each agent privately with some idiosyncratic noise, thereby avoiding common knowledge. As we have seen, an increasing precision of private information is always beneficial. However, our results indicate that even when the central bank provides private information to agents it should, in addition, publish information as precisely as possible to some group of agents. The higher the precision of private information is, the lower is the optimal degree of publicity. But, in our model it never falls below $1/(3r)$. The provision of private information should always be accompanied by some publication.

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